Agence spatiale canadienne | Canadian Space Agency

Canada

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1. International Assistance: RADARSAT-1 and 2 Monitored The Gulf of Mexico Oil Spill

Worldwide offshore resource-based operations such as fishing and oil and gas exploration and production have intensified over the past few decades. Government and industry require powerful solutions for assessing the resources and risks associated with the ocean environment. To monitor the world's oceans, Canada has provided Earth Observation (EO) radar data for operational applications such as ship detection, oil spill monitoring, and wind and surface-wave field estimation. On Thursday, April 22, 2010, a drilling rig located 70 km from the coast of Louisiana exploded and sank off the coasts of Louisiana and Mississippi, in the Gulf of Mexico. RADARSAT-1 and RADARSAT-2 images have been acquired to follow the evolution of the oil spill and were transmitted to the US Coast Guard, NOAA and USGS for disaster relief operations. To view the oil spill from RADARSAT-1 and RADARSAT2, please visit: www.asc-csa.gc.ca/eng/satellites/radarsat2/mississipi_oil.asp.

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2. Canadian Earth Observation Technology Contribute to Clean-up Efforts in Gulf of Mexico

In order to observe the clean-up efforts following the giant oil spill in the Gulf of Mexico on April 22, 2010, the US Geological Survey, on behalf of the US Coast Guard, requested satellite maps of the oil spill area. Envisat Earth Observation (EO) satellite has capture the oil that is spilling into the Gulf of Mexico after a drilling rig exploded and sank off the coasts of Louisiana and Mississippi. Thanks to the Canadian EO technology, this optical image of the oil spill (visible as a white whirl on the right) was acquired by the Medium Resolution Imaging Spectrometer (MERIS) on April 25, 2010. The Canadian Space Agency (CSA) contributed to the development of Envisat. During the development of Envisat, ABB Bomem of Quebec City (Quebec, Canada), developed software to allow the selection and generation of the MERIS instrument products. To view the MERIS image of the oil spill, please visit: www.esa.int/images/oil_slick_25April2010_1628.jpg.

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3. Canadian Program Aims to Reduce Marine Pollution With Earth Observation

The Canadian marine environment is the crossroads of the North Atlantic and Pacific for both transportation and seabird populations. The illegal release of oily wastes from ships traveling in Canadian waters is an ongoing issue and immediate challenge to the conservation and protection of the marine environment. Because of their behavior and location of habitat, over 25 species of marine birds in Canada are vulnerable to marine oil pollution.. On the east coast, some 30 million seabirds from Newfoundland, Labrador, the Eastern Arctic and Greenland winter in the waters off the southeast coast of Newfoundland every year. It is also estimated that in these waters, over 300 000 of these birds are oiled and killed annually. Similar statistics are not yet available for other Canadian waters, but significant negative impacts could potentially occur off the west coast. If the illegal oiling and killing of seabirds is not stopped, their populations could suffer long-term negative impacts. In 2006, Environment Canada's Canadian Ice Service took a significant step forward in the battle against marine pollution by assuming operational responsibility of the Integrated Satellite Tracking of Pollution (ISTOP) program. ISTOP is a satellite surveillance program for the detection of possible discharges of oil due to marine transportation and offshore oil production. It is a collaborative project that uses satellite image information to direct surveillance aircraft to suspected oil spill sites. It enables the routine monitoring of waters under Canadian jurisdiction through the collaboration and coordination of surveillance resources from multiple federal departments and agencies and private industry. Several government departments, including the Canadian Space Agency (Government Related Initiatives Program - GRIP), Environment Canada, Transport Canada, Fisheries and Oceans, the Coast Guard, and National Defence participated in the development of the project. For more information, please visit: www.ec.gc.ca/EnviroZine/english/issues/70/feature2_e.cfm.

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4. eSPACE: emergency Spatial Pre-SCAT for Arctic Coastal Ecosystems

Many Canadian Federal Departments have functional security and emergency preparedness responsibilities that pertain to, or are affected by, shipping activity in Arctic Canada. Environment Canada (EC) Wildlife and Landscape Science Directorate and the Environment Emergencies Section have an important role in terms of preparedness for a potential environmental emergency along the coastlines; however there is a significant information gap in the Arctic Region. The Arctic presents different challenges and its geography is impressive. There are many opportunities for economic development in the north, many of which involve activities that increase the risk of an incident that may impact local populations and the fragile ecology. Increased exploration activities, increased shipping traffic and climate change are three majors reasons why EC intends to initiate a national project in Canada's north to improve emergency preparedness and response. The eSPACE project, developed via the Canadian Space Agency (CSA) Government Related Initiatives Program (GRIP), is part of a new joint initiative from the CSA called MORSE - Arctic Coastal Initiative (www.morsearctic.net/). The initiative focuses on information needs of Arctic coastal ecosystems that can be satisfied by Earth Observation (EO) data from satellites. eSPACE is an multi-agency project to develop and

demonstrate the use of EO data for emergency preparedness and response and habitat conservation in Canada's northern coasts. Expected results and outputs of eSpace are: (1) spatially explicit coastal sensitivity and segmentation of shoreline maps for the 3 study sites in northern Canada; (2) improved capacity to use EO resources to support EC's mandate in the Arctic; (3) business case for full implementation of satellite coastal mapping for emergency preparedness and habitat conservation in Canada's north.

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5. Energy Corridors Security: Monitoring of Active Geohazard Sites in Canada

Threats to our environment are a clear and present danger that now confronts governments around the world. Over the last decade, the Canadian Space Agency (CSA) has been involved in the support of scientific initiatives, demonstration projects and operational implementation activities related to disasters and security management. Through the Government Related Initiatives Program (GRIP), Natural Resource Canada and the Alberta Geological Survey have developed InSAR ground deformation monitoring as a routine method of assessing energy corridors risk in Canada. The project established an InSAR monitoring baseline (i.e. RADARSAT-1, RADARSAT-2) for continuous integrated monitoring along Canada's strategic transportation and energy corridors, such as the Trans-Canada Highway in the Rockies, the Mackenzie Valley Pipeline, and the Alaska Highway. The techniques developed throught the project demonstrate the potential of RADARSAT-1 and 2 to improve the assessment and mitigation of geohazards, such as ground subsidence and landslides. This initiative is directly linked with the Global Earth Observation System of Systems (GEOSS) 10-Years Implementation Plan (section 4.1.1. Disasters: loss of life and property from natural and human-induced disasters) and contributes to the GEO Work Plan (i.e. DI-06-03: Integration of InSAR Technology).For more information, please contact vern.singhroy@ccrs.nrcan.gc.ca, corey.froese@ercb.ca or guy.aube@asc-csa.gc.ca.

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6. Environmental Applications and Services in SMOS Data Processing From Array Systems Computing Inc.

Array Systems Computing Inc. (Toronto, Ontario), a world leader in Earth Observation (EO) applications, has made significant contributions to the Soil Moisture and Ocean Salinity (SMOS) EO satellite employing innovative algorithms for estimation of soil moisture from L-Band telemetry. Launch in November 2009, SMOS will lead to major advancements in weather and extreme-event forecasting and climate monitoring. Array Systems can support universities, research institutes, government organizations and industry in exploiting SMOS data for environmental applications. For more information on Array's Soil Moisture Processing Services, please visit: www.array.ca/applications/radar/index.php.

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7. Ecological Integrity of the National Parks of Canada:

SARVEILLANCE Project

National parks have existed in Canada for well over a century. Through the Canadian Space Agency's (CSA) Earth Observation Application Development Program (EOADP), VIASAT GeoTechnologies, in collaboration with Parks Canada, carried out the SARVEILLANCE project, an applied research project on the potential of radar images for monitoring ecological integrity. It was carried out during the RADARSAT-2 launch period and was focused primarily on identifying and testing radar image processing and classification techniques for mapping protected areas. The main objective of the project was to utilize the potential of the enhanced capabilities of RADARSAT-2 in terms of selective polarization coupled with image segmentation and synthetic stereoscopy methods to characterize vegetation cover and to identify natural or human disturbances in protected natural areas and rural areas, in a perspective of environmental monitoring. The project has made possible the creation of value-added products in the form of colour images from multidate cross-polarized radar data that can be used as alternatives to medium-spatial resolution multispectral optical Earth observation (EO) images. For more information, contact shardy@viasat-geo.com or yann.denis@asc-csa.gc.ca.

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8. Contributing to Global Security: Canadian Earth Observation Technology Monitored The Ash Cloud From Iceland's Volcano

Our national security depends on global security. In April 2010, thousands of planes were grounded across Europe due to the spread of volcanic ash following the recent eruption under Iceland's Eyjafjallajoekull glacier. Volcanic eruptions eject large amounts of ash and trace gases such as sulphur dioxide into the atmosphere, often reaching the altitudes of scheduled flights. When flying through a volcanic ash cloud, ash particles enter the jet engines which can result in engine failure. The ash can also severely damage the material of the aircraft, clog its sensors, limit the view of its pilots, and severely scratch, or 'sandblast', cockpit windows, landing light covers and parts of the tail and wings. The Envisat Earth Osbervation (EO) satellite acquired multiple images of the heavy plume of ash traveling across Europe. The Canadian Space Agency (CSA) contributed to the development of Envisat satellite. During the development of Envisat, ABB Bomem of Quebec City, Quebec, Canada, developed software to allow the selection and generation of the MERIS instrument products. To view the MERIS images acquired on April 15 and 19, please visit: www.asc-csa.gc.ca/eng/programs/grip/archive_100422.asp.

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9. Eruption of the Eyjafjallajökull Volcano: Environmental Changes Seen by RADARSAT-2

The Canadian RADARSAT-2 Earth Observation (EO) satellite aacquired multiple images of the Eyjafjallajökull (Iceland) volcano. The images were acquired before and during the eruption. EO products, showing multiple land changes (i.e. modification of the drainage network, glacial lakes, agricultural lands, etc.) were delivered to regional civil protection services to better understand and manage the event. To view the RADARSAT-2 products, please visit: www.asc-csa.gc.ca/eng/satellites/radarsat2/iceland_volcano.asp.

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10. Contrail-free European Skies Seen With Canadian Earth Observation Technology

The Canadian Space Agency (CSA) contributed to the development of the Envisat Earth Observation (EO) satellite. These two Envisat (MERIS) images over the North Sea illustrate the absence of aircraft over Europe following the ban on air travel enforced due to safety concerns over volcanic ash plumes billowing from the recent eruption in Iceland. The first image, acquired on 21 March 2009, captures numerous aircraft condensation trails, or 'contrails', while the second image, acquired on 20 April 2010, shows a contrail-free airspace. Although the formation of contrails depends largely on weather conditions, it was very obvious over Europe (even from the ground) that there were very little contrails visible during the six-day shutdown. Exhaust emissions from jet aircraft contain large amounts of water vapour, which, under certain atmospheric states, will condense to form ice crystals. These act as condensation nuclei around which even more water vapour in the surrounding air condenses. The end result is the formation of an elongated cloud-like condensation trail in the sky. Also visible in the image are portions of the Netherlands (upper right), Belgium (lower right) and England (left). The various colours of green visible in the sea are due to sediments transported in the water. The images were acquired by Envisat's MERIS instrument, working in Full Resolution mode to provide a spatial resolution of 300 m: www.esa.int/images/english-channel-contrails_H.gif.

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11. Cryosat-2: Measuring the Changing Thickness of Ice and Extent of Marine Ice Fields in Canada

Ice caps and glaciers occupy 150,000 km2 of the Canadian Arctic Islands which, collectively, represents the largest area of land ice outside of the Greenland and Antarctic ice sheets. Another 50,000 km2 of land ice covers Canada's western and Northern Cordillera. These land ice masses contribute significantly to the change of sea level and flow of rivers. The thickness and extent of marine ice fields, or sea ice, is also a critical aspect of the functioning of the Arctic marine ecosystem, the global climate system, marine navigation and issues related to sovereignty and protection of the environment. Satellite images provide a good tool to determine the surface area and boundaries, but measuring the thickness could only be accomplished on single points by costly drilling through the ice. A new generation of Earth Observation (EO) satellites are about to change the way we measure the thickness and changing conditions of the ice. The Cryosat-2 EO satellite, launched in April 8 2010, is the most sophisticated satellite ever developed to study the Earth's ice fields. Cryosat-2 carry a single payload instrument, a new RADAR-altimeter called SIRAL. The satellite will take 20,000 measurements per second over the next three years with unequalled precision, and be able to detect changes in the thickness of the ice of only a few centimeters. Canadian scientists and researchers will play a key role in this mission by analyzing and validating data captured by the satellite. Their participation is made possible through the partial support provided by CSA's Government Related Initiative Program (GRIP). For more information, please visit: www.asc-csa.gc.ca/eng/programs/grip/archive_100407.asp. To view an animation of Cryosat-2 colleting cryosphere information, please visit: download.esa.int/mpeg/CryoSat-SAR-functioning_H264.mp4.

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12. Antarctica: Giant Iceberg Monitored With Canadian Earth Observation Technologies

Antarctica is the coldest, driest, highest (on average), and windiest continent, with 99% of its area covered by a permanent ice sheet. Weather conditions are severe and changeable. This polar region is also the home of spectacular wildlife, volcanoes, hot springs and colossal icebergs. RADARSAT-2 capabilities that benefit sea-ice applications are the multi-polarization options that improve ice-edge detection, ice-type discrimination, and ice topography and structure information. An animation, made up of ten images acquired by RADARSAT-2, shows the close to 50km movement of the C-28 iceberg (in yellow) separated from Mertz Glacier in Eastern Antarctica. The separation of this giant mass of ice was due to a collision that happened in February 2010 with the 97 km long B-9B iceberg (right). The product was developed by CSA Earth Observation Applications and Utilizations (EOAU) Division. The information is complementary of the ENVISAT Advanced Synthetic Aperture Radar (ASAR) animation developed by ESA in March 2010. To learn more and to view the animation, please visit: www.asc-csa.gc.ca/eng/satellites/radarsat2/featured_antarctica.asp.

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13. 3rd RADARSAT-2 Workshop: On-line Registration Now Available

After 2 years of successful operations of RADARSAT-2, the time has come to bring together the international radar community to present the full potential of the satellite. The Canadian Space Agency (CSA) has committed to objectives that pertain to natural resource management, environmental monitoring and coastal surveillance. RADARSAT-2 data is being used by the Government of Canada to meet the current and evolving priorities of the Government, and also to foster the research and development for new applications or for improving existing ones. The third RADARSAT-2 Workshop, will take place at the Canadian Space Agency, St-Hubert, Quebec, Sept 27 - Oct 1 2010. The main objective of the Workshop is to inform all potential users of the utilizations of RADARSAT-2 data from an operational, commercial and R&D perspectives. For more information, please visit www.asc-csa.gc.ca/eng/events/2010/radarsat2.asp or contact daniel.delisle@asc-csa.gc.ca.

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14. Knowledge Advantage: Geopositioning and Radargrammetry Workshop in Montreal

To succeed in an increasingly competitive global arena, Canadians must be at the leading edge of important developments that generate health, environmental, societal, and economic benefits. A workshop, organized by the Assocation québécoise de télédétection, will be held on Thursday, May 20th 2010 at the Université du Québec à Montréal. The first part of the workshop will cover practical GPS techniques for easy and precise positioning while the second part will focus on satellite radargrammetry: challenges and applications with RADARSAT-2. The cost of the workshop is $ 140 for AQT members and $ 160

for non-members. This workshop will be given in French. To register or to obtain more information: info@laqt.org.

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15. Measurement of Pollution in the Troposphere

The Canadian instrument MOPITT (Measurement of pollution in the troposphere) is celebrating its 10th anniversary of successful operations in March 2010. Launched in 1999 aboard NASA's satellite TERRA, MOPITT has been continuously scanning the Earth's atmosphere to make long-term measurements of carbon monoxide concentrations. This instrument is a Canadian contribution to NASA's Earth Observing System (EOS), an international environmental study project. Under the leadership of the Canadian Space Agency (CSA), MOPITT was designed by researcher Jim Drummond from the University of Toronto and built by COM DEV International from Cambridge, Ontario, MOPITT was initially planned for a five-year term, however, the experiment has been prolonged given the quality of the data collected and the good health of the satellite. The accurate and efficient MOPITT probes every part of the atmosphere in four days. Ten years of providing information on the atmosphere to help scientists to forecast the long-term effects of pollution, to understand the increase in ozone concentrations in the lower atmosphere and to orient the assessment and implementation of short-term pollution controls. For more information, please visit: www.atmosp.physics.utoronto.ca/MOPITT/home.html.

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